**Name _____**

# NASA/Tropical Rainfall Measuring Mission (TRMM)
## Topic #5: Rain
## Activity #1: Narrative on Rain

**OBJECTIVE:** To introduce concepts related to the formation of rain and explore the methods used by the TRMM satellite to measure tropical rainfall.

**WHAT'S HAPPENING?**

Clouds form when saturated (100% relative humidity) air is cooled to the temperature at which the water vapor condenses into tiny cloud droplets of water or ice (the dew point). Typically, warm, humid air rises to higher altitudes where it cools and condenses to form clouds. As the cloud develops, **updrafts** continue to support the tiny (20 micrometers) cloud droplets or ice crystals. As these droplets contact each other they become larger. For rain to begin falling, the droplets must grow too large to be supported by the updrafts. The size of an average raindrop is 2000 micrometers or 2 millimeters. As they fall, collisions with other drops results in larger drops. If a falling drop reaches 6 mm (1/4 inch), the upward force of the air resistance flattens the drop and begins to break it into smaller drops. Rain is also produced when falling ice crystals (snow) melt as they fall through warmer air.

One of the exciting features of the TRMM satellite is that it carries the first rain radar ever launched in space. Presently only about 2% of the planet is covered by ground based radar. From its orbit of 215 miles (350 km) above the Earth, the **TRMM** instruments are able to make rainfall measurements over **remote** areas of land or water where data is difficult, if not impossible, to collect. The TRMM satellite is designed to make observations in the tropical regions between 35 N and 35 S latitudes. Two thirds of the Earth's rainfall occurs in this region. As the water vapor condenses to produce rain, it releases stored heat energy. This release of energy affects the temperature of the atmosphere and affects our global climate. Scientists need data from this region to improve global weather and climate models for the purpose of long range forecasts.

The Precipitation Radar sends a pulse of microwave energy into the atmosphere. If it strikes **precipitation** such as rain, part of the energy is reflected back to the radar. These signals (called backscatter) are interpreted by scientists who display the data as colors on a satellite image.The radar is designed to provide a rainfall profile or side view (See Figure #1) up to a height of 12 miles (20 km). The profile measurements will give information on the amount of rain, its location in the cloud and the height at which the snow melts into rain. The accuracy of this instrument is dependent on the size of the raindrops. Early results indicate that raindrops may be much smaller than scientists originally believed. Scientists are now investigating ways to accurately measure the size of raindrops as they strike the surface. A new method being used to measure raindrop size is based on the sound produced by rain as it lands in the ocean. The sound is louder for large drops than for smaller drops. These "sound signatures" will be compared to the data

collected by the sensors on the TRMM satellite. This process will enable scientists to validate (check) the accuracy of the Precipitation Radar and improve their rainfall estimates.

**VOCABULARY:**
**Precipitation -** moisture in the atmosphere such as rain or snow
**Remote –** located far away
**TRMM -** Tropical Rainfall Measuring Mission
**Updraft –** rising air currents

**YOUR THOUGHTS:**
1. Describe the formation of a cloud._____

2. What force limits the size of a falling raindrop? _____

3. Why is it helpful to scientists to be able to measure rainfall from a satellite?

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4. How does the information provided by a radar profile give scientists a better

understanding of rain? _____

5. How are scientists planning to check the validity (accuracy) of the radar images?

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FIGURE #1:
**Hurricane with Profile of Rain**
KEY: (highest rainfall to lowest):
red,yellow, green, light blue, dark blue